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Weight Control in Logging Trucks

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Weight Control in Logging Trucks

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Abstract:	A recent weight survey of logging trucks showed most of them were significantly overloaded. This could be due primarily to MTC's inability, using the existing short-platform scales, to accurately weigh the type of tractor/semi-trailer combination commonly used for logging operations. This configuration consists of a long triple axle and an air-lift axle in the semi-trailer. It is concluded from the analysis of the survey that the existing logging trucks will have large axle overloads even if loaded to within the legal gross weight limits. In order to ensure compliance with the axle weight limits, gross weight will have to be significantly reduced from current limits. It is recommended that axle weight control should be retained and multi-platform scales be installed to permit accurate weighing of logging trucks.
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SUMMARY

Short platform scales can not fully accomodate a long triple axle commonly present in a logging truck. Split weighing of these axles has resulted in large weighing errors. Due to this reason it is not possible to accurately determine the gross vehicle weight (GVW) in most of the logging trucks at the truck inspection stations equipped with a short platform scale. Hence, the GVW is generally not enforced in the logging trucks at the truck inspection stations except that, trucks are occasionally stopped on the highway and escorted to the nearest long platform scale which can weigh the full truck to obtain the GVW. These long scales, however, are not used to determine the axle weights.

Inability to accurately weigh the logging trucks is seriously undermining our weight enforcement program. Compelled by the economic pressures, the raw forest products industry has taken full advantage of the situation by designing tractor/ semitrailer combinations which they are able to seriously overload beyond the current legal limits without being detected. This has been causing accelerated damage to the highway system.

Ministry is planning to instal a number of multiplatform scales in the Northwestern Region in the vicinity of Thunder Bay to improve weighing capability and hence the weight enforcement. With this it will be possible to enforce the legal limits for the GVW and the triple axle weight more effectively. The industry appears to be concerned because they may have to significantly reduce payload from the current levels to stay within the legal gross and axle weight limits. In order to minimize the impact on their operation they are demanding to eliminate the axle weight control.

A weight survey was conducted to study the situation. It is concluded that the existing trucks will have large axle overloads even if loaded to within legal gross weight limits. In order to eliminate the need for axle weight control legal gross weight limits will have to be significantly reduced.

It would be worth noting that prior to the introduction of axle weight control in Ontario in 1970, the maximum allowable legal gross weight on a tractor/semitrailer combination with at least three axles in each of the vehicle units was only 38 200 kg as compared to the current limit of 50 000 to 60 000 kg, made possible by the introduction of the axle weight control.

It is recommended that axle weight control be maintained in order to be able to allow current levels of legal GVW. Lowering GVW limits to ensure that axle weights limits will not be exceeded, may have a serious negative impact on the industry, and therefore, may not be acceptable to them.

1. INTRODUCTION

1.1 Purpose of the Study

During the fall of 1986, raw forest products industry in the Northwestern Region presented a demand to the Ministry that axle weight control be removed from the logging trucks, and that they be allowed to carry as much load as may be possible within legal length and height limits on such trucks. They argued that due to the variability in the density of different types of wood and the changes in the moisture conditions round the year [1], the industry has difficulty in accurately loading the trucks within legal limits. Furthermore, they argued that location of the centre of gravity in the tree length logs of different sizes varies along the length of the log, and hence, they have difficulty in proper positioning of the load on the truck to avoid axle overloads.

A preliminary study in December,1986 showed that removing the axle weight control would seriously undermine the weight enforcement program and would not be technically acceptable to the Ministry. Also the logging trucks if loaded to the legal height would be overloaded by as much as 30 to 40 percent on the gross vehicle weight (GVW) which would seriously compromise the safety of highway bridges, and prematurely damage the pavements.

The industry was informed of the Ministry's concerns and unacceptability of their demands. They agreed to abide with the GVW limits per the Highway Traffic act and Regulations [2] but persisted in their demand for removal of the axle weight control.

This raised two questions,

1. If the logging trucks are loaded to the GVW limit per HTA, would there be serious axle overloads ?

2. What should be the GVW limit to ensure that the axles will not be overloaded ?

In order to answer these questions this study was undertaken. A survey was conducted to collect data on the existing truck configurations around Thunder Bay and current situation was evaluated. This report contains the results of this survey and the recommendations from the study.

1.2 Background

Current Highway Traffic Act and Regulations contain a series of vehicle weight tables which were introduced in 1978 for weight control, replacing the Ontario Bridge Formula (OBF) [3]. These tables were generally based on the OBF but occasionally exceeded the formula as a result of the Ministry's decision during the development of the tables to not penalize any existing truck unfairly as a result of the transformation.

The weight regulations require to check,

(a) wheel pressure from the individual axles, particularly the front axle.

(b) weight on individual axle units (single, dual, or triple) based on the axle spacing,

(c) weight on a group of axle (two-, three- or four-axle group) closely spaced, based on the axle group spacing, and

(d) gross vehicle weight (GVW) based on the front axle weight, base length of the vehicle, and the inter-vehicle-unit distance as defined in the Regulations.

To carry out the above checks, it is necessary to accurately weigh various axle units and measure all interaxle spacings. Axle group weights and the GVW can then be determined by adding axle unit weights.

Truck inspection stations in the Northern and Northwestern Regions, where the raw forest product industry is the main user of our highways to transport logs to the mills, are equipped with short 3 m platform scales to weigh the logging trucks. The procedure to weigh a truck using these scales is illustrated in Figure 1. The truck is moved forward to successively position the axle units on the scale to weigh the axle unit. Figure 2 shows a logging truck on scale at the Thunder Bay South truck inspection station.

If a truck is found to be overloaded, charges are laid if the amount of overload exceeds 250 kg. on an axle unit or 1 000 kg on the GVW. If the GVW overload exceeds 3 000 kg, the truck is required to off-load. In that case some logs are dumped off the truck at the inspection station as shown in Figure 3.

Most common truck configuration used to transport logs is a seven axle tractor/semitrailer combination, 3S4, as shown in Figure 4. The four axle semitrailer in these combination is equipped with a single air-lift axle and a long triple axle with axle spacing varying from 3.5 to 4.1 m.

Existing 3 m platform scales, however, can not fully accomodate such a long triple axle. Split weighing of these triple axles results in large weighing errors [4]. Also weighing of trucks with an air-lift axle using the above procedure results in large weighing errors due to the load transfer between axle units as the truck is moved to a new position on the scale. This error depends upon the longitudinal profile of approaches to the scale. As a result the Ministry's staff was unable to accurately weigh these trucks using short platform scales, and hence, had problem enforcing GVW limits. The weight limit on the long triple axle was not enforced but on a limited basis GVW limit was enforced by using long 24 m platform scales at the mills or in the city. The detected overloads on the drive tandem were found to be significantly high as is evident from data from the regular charges during the month of November,1986 shown in Figure 5.

Compelled by the economic pressures the industry developed new vehicle configurations to make best of the existing situation. They introduced additional single air-lift axles to form five or six axle trailers, as shown in Figure 2, which they could load to much higher GVW than the legal limits without seriously overloading the axles.

However, the overloads on the logging truck have been damaging our provincial highways. Figure 6 shows a damaged segment of the southbound lane of Hwy. 527 near Thunder Bay, used mainly by the loaded logging trucks. The asphalt from the road has been pushed aside under the effect of heavy axles and piled along the edge of the pavement.

To resolve the weighing problem, the Ministry decided to instal multiplatform scale system [5] at four locations in the Northwestern Region. The system for one way operation consists of five platforms; 3, 5, 5, 3, and 8 m in length. The weighing procedure is illustrated in Figure 7. The full vehicle is positioned in such a way that each axle unit is simultaneously located on a different platform and the full truck is weighed in one setting. The platform combination for the Northwestern Region will be required to operate for two way traffic and, therefore, will consist of seven platforms; 3, 5, 3, 2, 3, 5, and 3 m in length.

This decision seems to have caused a concern for the raw forest products industry because the Ministry will now be able to enforce current weight regulations more effectively and the industry may have to significantly reduce the payload to bring the existing trucks weights down from the current overloaded levels to within the current legal limits.

2. DATA COLLECTION

2.1 Charges from the Regular Operation

Data from regular charges for the months of October/ November,1986 were collected from the files at Thunder Bay. These showed serious overloads on the drive tandem and for the GVW. No data were available for the overloads on the triple axle. The overloads on drive tandem are shown in Figure 5. Whereas most of the charges laid were between 1 000 to 3 000 kg, overloads as high as 7 110 kg were observed on the tandems. Overloads for GVW were as high as 18 800 kg, or approximately 30 percent of the legal GVW limit. It may be noted that during this period winter increase of 10 percent over the legal limit was not in effect.

2.2 Weight Survey on the Highways

Trucks were weighed using portable scales and measured at three locations around Thunder Bay during February, 1987,

-Hwy. 527 at Hwy. 11/17 at the Ministry's patrol yard.
-Thunder Bay S truck inspection station on Hwy. 11/17.
-Thunder Bay N truck inspection station on Hwy. 102.

In order to minimize potential weighing errors, six portable scales were used to weigh all tractor axles or all axle within a trailer triple simultaneously. To lift all axle of the semitrailer to the same height dummy pieces of plywood of approximately same thickness as the portable scales were used. When weighing the single air lift axles, the pieces of plywood were placed under one or more axles in the trailer triple. If the tractor was equipped with an extra air-lift axle, similar procedure was adopted for weighing the tractor. Measurements included interaxle spacings, location of the king pin, and the location of the front and the rear of the load.

Table 1 gives the number of trucks of various types and configurations surveyed at the three locations, categorised by type of logs carried.

Table 1/ Number of Trucks surveyed

Config.	Hwy. 527			Thunder Bay N			Thunder Bay S			Total
	EFL	SFL	TLL	EFL	SFL	TLL	EFL	SFL	TLL	
3	1	0	0	0	0	0	0	0	0	1
3S3	3	0	0	1	0	0	7	0	0	11
3S4	19	42	0	0	14	24	39	9	6	153
4S3	0	0	0	0	0	0	1	0	0	1
3S5	0	3	0	0	0	0	3	0	0	6
4S4	1	0	0	0	0	0	0	0	0	1

EFL = 8 ft. logs, SFL = 16 ft. logs, TLL = tree length logs

2.3 Gross Weight Survey at the Mill Scales

GVW data were also collected at four mill scales by spending a day at each of these scales. This consisted of the following types and numbers of truck,

-Northern Wood Preservers - 7, all 3S4 configuration, all carrying 16 ft. logs.

-Great West Timber - 18, all 3S4 configuration, 15 trucks carrying 16 ft. logs and the remaining tree length logs.

-Abitibi Price Timber - 14, all 3S4 configuration, all carrying 8 ft. logs.

-Great Lake Forest Products - 43 with configuration 3S4, 2 with configuration 3S3, all carrying 8 ft. logs.

3. CURRENT SITUATION

3.1 GVW from Survey on the Highways

Distribution of GVW of all trucks from the survey conducted at the truck inspection stations and Hwy. 527 is shown in Figure 8. The trucks with less than seven axles, and most of the trucks with seven axle carrying tree length logs, have GVW between 44 000 to 55 000 kg. Majority of seven or more axle trucks carrying 8 ft. logs or 16 ft. logs have GVW between 60 000 to 70 000 kg.

Figure 9 displays the distribution of legal GVW limit on all seven axle trucks of configuration 3S4 determined in accordance with the HTA. Average legal GVW for trucks in this category comes out to be about 58 000 kg. A comparision of the actual GVW with the legal limit is presented in Figure 10 for all trucks categorized by the type of logs. Surprisingly, those loaded with tree length logs were generally found to be within the legal GVW limit while those loaded with 8 ft. or 16 ft. logs were generally exceeding the legal GVW limit. It should, however, be noted that while survey was being conducted, the winter allowance of 10 percent above the legal limit was in effect. Even then about 34 percent of the trucks were overloaded by more than 10 percent, largest amount of overload being about 25 percent. GVW overloads for six and eight axle trucks are given in Table 2 and 3, respectively. As is clear from these Tables, GVW overloads are high in these trucks as well.

3.2 Axle Weights from the Survey

Figure 11 diplays the distribution of overloads on axles in

seven axle trucks, configuration 3S4, expressed as percent of legal limit. About 80 percent of the total trucks have overload on the drive tandem out of which 41 percent even exceeded the winter allowance of 10 percent. As for the triple axle the above figures are 78 and 50 percent, respectively. Overall about 87 percent of the total trucks were overloaded on either the drive tandem or the triple axle and in 60 percent of the cases the overload exceeded the winter allowance of 10 percent over the legal limit. Largest amount of overloads on the axles were of the order of 35 percent of the legal limit.

To study the relationship between the axle overloads and the GVW, ratio of the actual axle weight to the legal axle weight is plotted vs the actual GVW in Figures 12 and 13. Figures 12(a) and 12(b) are the plots of the tandem and triple axle weights, respectively, for the 3S4 trucks loaded with the 8 ft. logs. Figures 13(a) and 13(b) are similar plots for trucks loaded with the 16 ft. logs. From these plots it is difficult to establish a definite relationship between the axle weights and the GVW but a few of the following observations are made,

(a) Axle overload is possible at GVW significantly lower than the legal limit. Overload of about 7 percent was observed in a truck loaded to 55 000 kg.

(b) Triple axles have larger percent overload than the dual tandems. This is also evident from Figure 11. Considering that the legal load on a triple axle is larger than a dual tandem, actual overloads on triples are much larger in kilograms compared to the tandems. Unfortunately, these are not being detected in the current practice.

(c) Axle overloads are higher in trucks carrying 16 ft. logs.

Tables 2 and 3 list overloads in the six and eight axle trucks, respectively. axle overload problem is even more serious in six axle trucks. However, eight axle trucks may have little or no axle overloads if loaded to a GVW of less than 60 000 kg.

3.3 GVW from the Mill Scales

Distribution of all truck from various Mill scales is shown in Figure 14. Generally it agrees with the survey from the highway locations with respect to the load level. Trucks loaded with the tree length logs were carrying comparatively smaller load. Figure 15 shows distribution of trucks grouped by the load type. On an average higher GVW was observed in the trucks carrying 8 ft. logs, even higher than 10 percent above the legal limits permissible during winter months, but the scatter of GVW was greater in the trucks carrying 16 ft. logs.

Table 2/ Overloads in the Six Axle Trucks

Truck No.	GVW (kg)	Overloads (kg)			
		Drive Dual	Trailer Dual	Triple	GVW
501	59 100	900		9 650	10 550
502	51 300	200		1 150	1 350
504	51 610	985	-		110
505	49 660	-	-		-
506	56 400	2 660	621		4 460
508	44 800	-	-		-
510	53 950	1 250		4 750	6 000
512	51 180	40	1 620		280
513	56 750	2 250		6 650	8 900
514	54 250	1 075		5 350	6 425
515	55 275	1 050		5 950	7 000

Table 3/ Overloads in the Eight Axle Trucks

Truck No.	GVW (kg)	Overloads (kg)		
		Drive Dual	Trailer Triple	GVW
401	71 550	1 390	3 080	9 250
402	65 300	-	1 260	7 300
403	58 640	-	-	-
404	65 640	2 276	5 500	5 036
405	69 600	250	5 075	8 100
406	74 610	1 590	5 500	14 510
407	70 250	900	1 800	7 950

4. EFFECT ON THE HIGHWAY SYSTEM

4.1 Effect on Bridges

The basis for the legal weight limits in Ontario is the Ontario Bridge Formula (OBF) which represents a safe operational level of loading for bridges, determined through an indepth study of the load carrying capacity of the existing bridges [6]. The live loading model for strength design in the Ontario Highway Bridge Design Code [7] is at a level 10 000 kg higher than the OBF and is commonly known as the MOL level. These two levels are shown in Figures 16(a,b and c) which also show a plot of GVW of trucks from the survey categorised by the type of load. While GVW in most of the trucks carrying 8 ft. or 16 ft. logs exceed the OBF, a number of trucks have GVW even higher than the MOL level thus seriously using up portion of the safety margin required by the sound engineering principles for a safe regular operation.

The heavy axle loads and the GVW observed in the logging trucks cause accelerated damage to the bridge decks, the structural steel components, and the connections by reducing their fatigue life. The above loads in the logging trucks will effectively reduce bridge fatigue life by about 40 percent. Also it will require more frequent repairs than if the loads are kept within the legal limits. Simultaneous presence of more than one such heavily loaded trucks also increases the risk of bridge collapse which may result in loss of life and property including damage to the trucks.

4.2 Effect on the Pavements

Pavement damage by heavy vehicles is identified by the appearance of longitudinal fatigue cracks in the wheel tracks and by deep ruts in the pavement surface. Both fatigue cracking and rutting are the accumulated result of wheel loads on the pavement. They appear earlier and are more severe when wheel loadings are excessive.

Figures 17 and 18 display the variation in the "Relative Damage Factor" with the GVW. It is defined as the ratio of the total damage factor (expressed as the equivalent number of passage of the 18 kips load) due to the actually loaded truck to that due to the legally loaded truck. Figures 17 (a,b and c) show the 3S4 trucks categorised by the type of load and Figure 18 displays the eight axle trucks.

The axle loads measured in this survey reveals excesses of 1000 to 2 000 kg on any axle in a dual or triple axle configuration. This may represent about 30 percent increase in payload but correspondingly there is a 100 percent increase in pavement damage. This is clearly illustrated in Figures 17(a,b and c) and 18 where the relative damage

factor for a legally loaded vehicle when compared with a vehicle with about 30 percent more payload (for a seven axle vehicle about 68 tonnes; for an eight axle vehicle about 71 tonnes) shows increases in pavement damage of 120 percent for the seven axle vehicle, and 100 percent for the eight axle vehicle. Also seven axle trucks loaded to about 57 000 kg and eight axle trucks loaded to about 59 000 kg will cause about the same damage as the legally loaded trucks.

To illustrate the effects of overloaded vehicles on the pavement, let us consider Hwy. 527 which is primarily used by the logging trucks. The first 12 km north of its junction with Hwy. 11/17 was paved ten years ago, in 1977, with 1.5 inches of hot mix asphalt in accordance with the Ministry's Guidelines [8]. The next 34 km was paved sixteen years ago, in 1971, also with 1.5 inches of hot mix asphalt, but it needed extensive patching within 6 years, and this was done in 1977 at the same time as the first section was being paved. The pavement design used throughout is in accordance with the structural design guidelines for the class of road, traffic volume of less than 2000 vehicles per day and silty/clay sand subgrade, i.e. 1.5 inches of hot mix over 6 inches of Grannular A base, over 6 inches or more of Grannular C sub-base.

The present condition of the highway, which currently carries about 1300 vehicles per day, of which 18-25 percent are trucks, can generally be described as in only fair condition. Results from the measurements with a Mays Ride Meter, given in Figure 19, show that in the southbound lane where the loaded logging trucks travel, 19 percent of the 46 km is slight to fairly rough, 20 percent is rough, and a full 59 percent is very rough. In contrast, in the northbound lane where logging trucks are returning empty, 28 percent shows slight to fairly rough, 36 percent in rough, and only 34 percent in very rough condition. Severe rutting is present, and moderate multiple longitudinal wheel track cracking is frequently observed, in addition to other types of pavement distress. Pavement deterioration of the last 34 km of this highway is such that rehabilitation is planned within the next few years. In the meantime, continued patching is envisaged.

The effect of early pavement deterioration on the road user is generally a 5-10 km per hour lower average speed, higher fuel consumption, and higher vehicle maintenance costs.

5. POTENTIAL AXLE OVERLOADS IF LOADED TO LEGAL GVW LIMIT

Seven axle trucks from the survey were analysed to determine potential overloads on axles if they are loaded to the GVW limit per the HTA. If a truck carried higher than the legally permissible GVW, the overload was removed and load taken off from the various axle in such a way that the relative distribution of the payload over various axles remained unchanged. Ir after this reduction, the air-lift axle remained overloaded, the amount of overload was transferred to the drive tandem and the trailer triple statically. This was done assuming that the load on the air axle could be adjusted by proper air pressure. For truck carrying tree length logs where GVW was generally below the legal limit, load was increased to the legal GVW limit in the same way.

Results of this analysis are displayed in Figure 20 categorized by the load types. It is evident that the trucks could potentially have significant amount of overloads on the tandem or triple axles even when the GVW is within the legal limits. Potential overloads are larger with 16 ft. logs or tree length logs, compared to the 8 ft. logs, indicating greater problem in properly distributing load amongst the axles. These potential overloads are large and can not be ignored.

The six axle trucks of configuration 3S3 were also analysed in the similar way and the results are given in Table 4. Six of these trucks have a triple axle in the semitrailer, while the other five have a single air-lift axle together with a dual axle in the semitrailer.

Table 4/ Potential Axle Overloads in the Six Axle Trucks if Loaded to the Legal GVW Limit

Truck No.	Axle Units in the Semitrailer	Potential Overload (kg)	
		Dual Axle	Triple Axle
501	triple	-	2880
502	triple	-	304
504	single, dual	946	-
505	single, dual	356	-
506	single, dual	953	-
508	single, dual	-	-
510	triple	-	1094
512	single, dual	1499	-
513	triple	-	1198
514	triple	-	1206
515	triple	-	934

6. MAXIMUM GVW WITHOUT OVERLOADING AXLES

Further analysis was conducted to determine the maximum GVW for each of the seven axle truck, for which all axles will be within the legal limits. The results of this analysis are shown in Figure 21 categorized by the load type. As expected the scatter is larger for the 16 ft. logs or the tree length logs indicating greater difficulty in properly distributing load amongst the axles. In order to make absolutely sure that the axles will not be overloaded, the allowable GVW may have to reduced to as low as 48 000 kg. This would still be larger than 38 200 kg that was permitted in Ontario on such trucks prior to 1970 when the axle weight control was introduced. A value of about 54 000 kg could be considered reasonable for GVW limit in 3S4 trucks without axle weight control. This may be too restrictive for some better designed trucks but may incur significant axle overloads in the others.

Similar analysis was conducted for the six axle trucks as well. Allowable GVW for the trucks with triple axle in the semitrailer is found to from 44 062 kg to 49 465 kg with an average value of 46 417 kg. For the trucks with a single and a dual axle in the semitrailer, the allowable GVW was found to be from 47 426 kg to 49 775 kg with an average value of 48 652 kg. To ensure no axle overload , allowable GVW should be reduced to about 44 000 kg but it may be too restrictive. A value of about 47 000 kg may be a good compromise.

7. USE OF B-TRAINS

Difficulty of properly loading on a tractor/semitrailer can be largely overcome by the use of a B-train for transporting logs. This will provide greater flexibility in the design of vehicle combinations as well as the vehicle loading. An example is shown in Figure 22. Not only this will allow to load upto the legal limits of upto 63 500 kg without overloading the axles, but also such trains would not require to have an air-lift axle and would be easier to steer and maneouvre. Moreover, load will be better secured when placed lengthwise rather than crosswise.

8. WINTER ALLOWANCE OF 10 PERCENT

During the winter freez up months in the Northern Ontario an overload of 10 percent, both on axles and the GVW, is permitted for logging trucks. The allowance was given to the industry in 1970 through an amendment to the HTA at about the same time that the Ontario Bridge Formula was

introduced for the weight control. This allowance was asked by the industry on the grounds that they lose part of the payload during the winter months due to snow and ice accumulation on the logs. The Ministry accepted the request from the pavement considerations noting that the road subgrade becomes stronger due to the freez-up in the winter, and hence, pavement is capable to carry higher axle loads.

During the revision of the weight Regulations in 1978, legal weight was increased by 10 percent on a single axle together with general increase in the allowable weights on the dual and triple axles but the provision of the winter allowance was not reviewed. Whereas the pavements may be capable to carry higher axle weights during the winter months, bridge capacity will not be any greater. Since gross weights are critical for the bridges, and the HTA limits for GVW are already as high as can be allowed by the load carrying capacity of the existing bridges, as reflected by the OBF, the overload allowance during winter for the GVW limit is detrimental to the bridges.

9. CONCLUSIONS AND RECOMMENDATIONS

1. Using short platform scales at the truck inspection stations, existing logging trucks can not be accurately weighed. This is seriously undermining our weight enforcement program in the Northern Ontario.

2. Logging trucks are travelling on our highways with serious overloads causing accelerated damage to the highways.

3. Using a multi-platform scale system will give the Ministry the capability to accurately weigh the logging trucks and hence enforce the weight regulations more effectively.

4. Allowing logging trucks to carry GVW upto the current HTA limits without controlling axle weights will result in significantly large axle overloads. Therefore, axle weight control must be retained. Moreover, removing axle weight control from the logging industry will lead to the pressures from other segments of the industry to do the same for them also. However, if removal of the axle weight control is to be considered for the logging trucks, legal GVW limits should be reduced to,

six axle trucks (3S3)	47 000 kg
seven axle trucks (3S4)	54 000 kg
eight or more axle trucks (3S5)	59 000 kg

5. Use of B-trains should be encouraged as an alternative to the tractor/semitrailer type trucks.

6. Ministry should consider eliminating the winter allowance of 10 percent for the gross vehicle weight. The allowance, however, may continue to apply to the axle weights.

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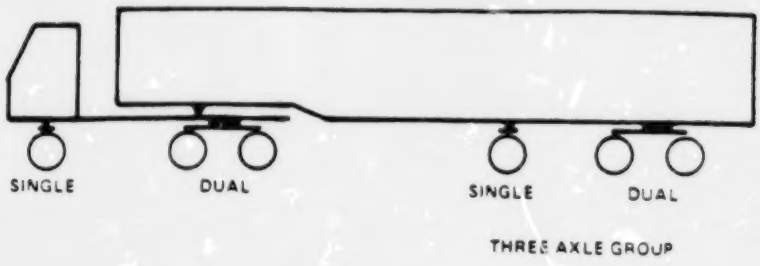


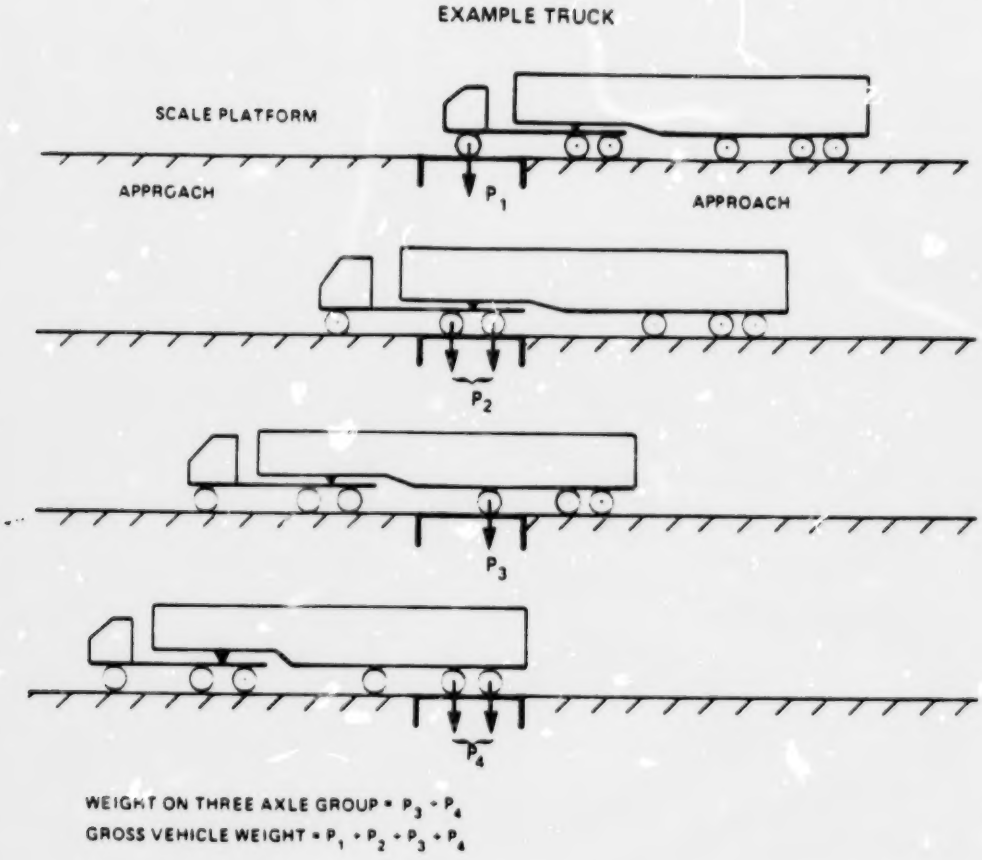


Figure 1/ Weighing procedure using a short platform scale

Figure 2 Eight-axle logging truck on a weigh scale at the Thunder Bay South truck inspection station

Figure 3: Unloading an overloaded logging truck at a truck inspection station

Figure 4/ A typical truck, configuration 3S4

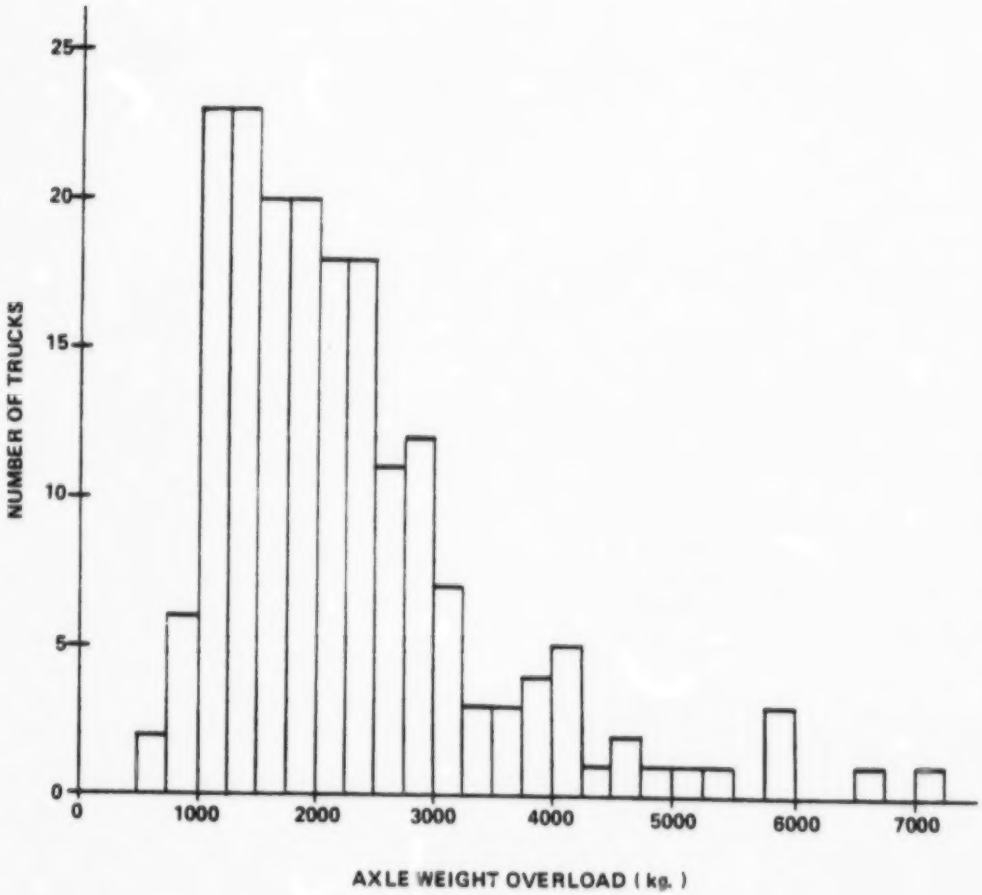


Figure 5/ Regular data from charges during November, 1986, from Northwestern Region for axle weight violation in logging trucks

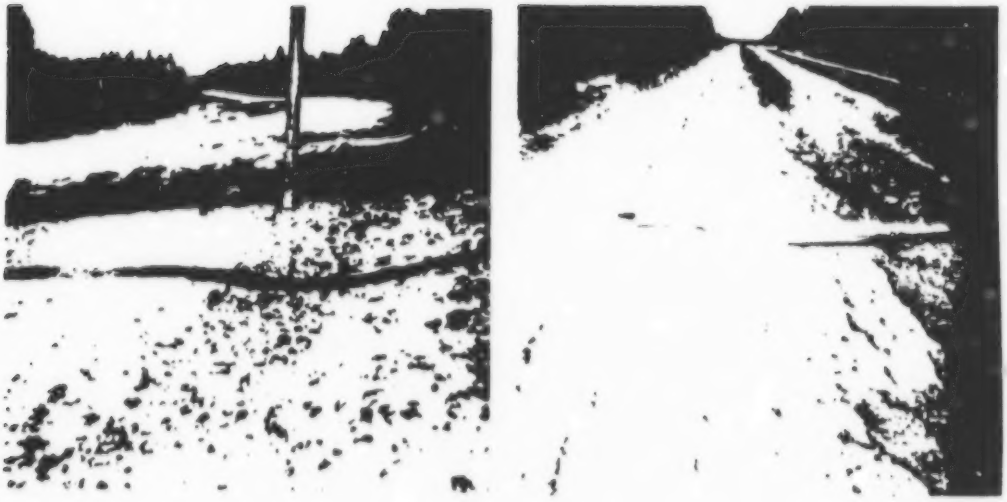


Figure 6/ Pavement damage to the southbound lane of Hwy 527

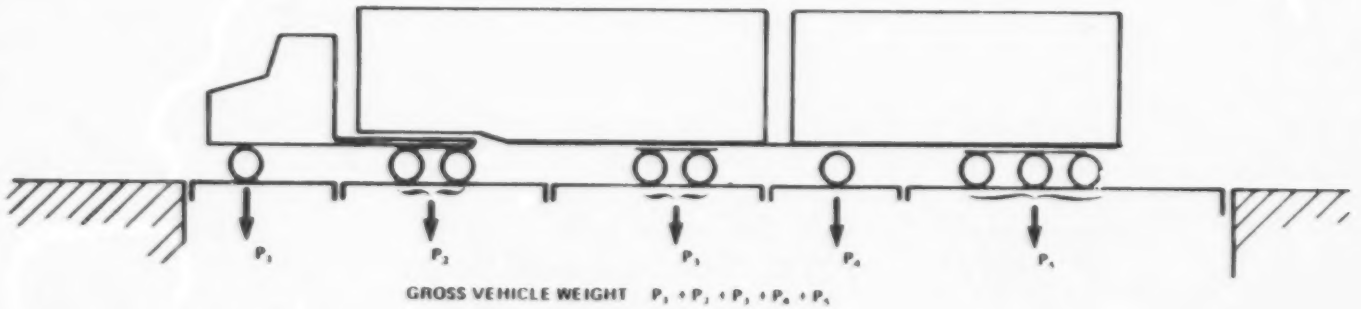


Figure 7/ Single-position weighing of the vehicle using multi-platform scale

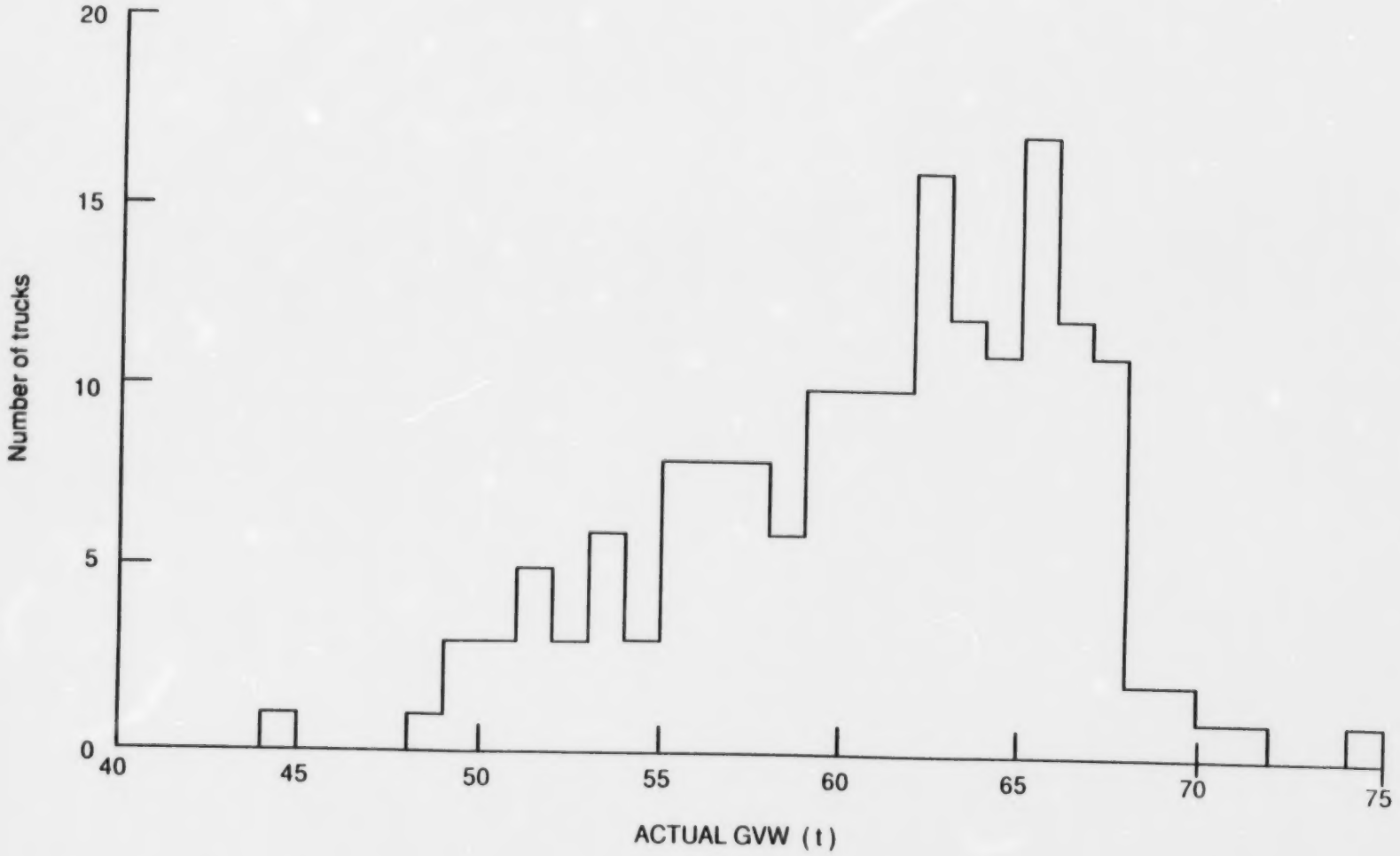


Figure 8/ Distribution of gross vehicle weight of all trucks from the survey

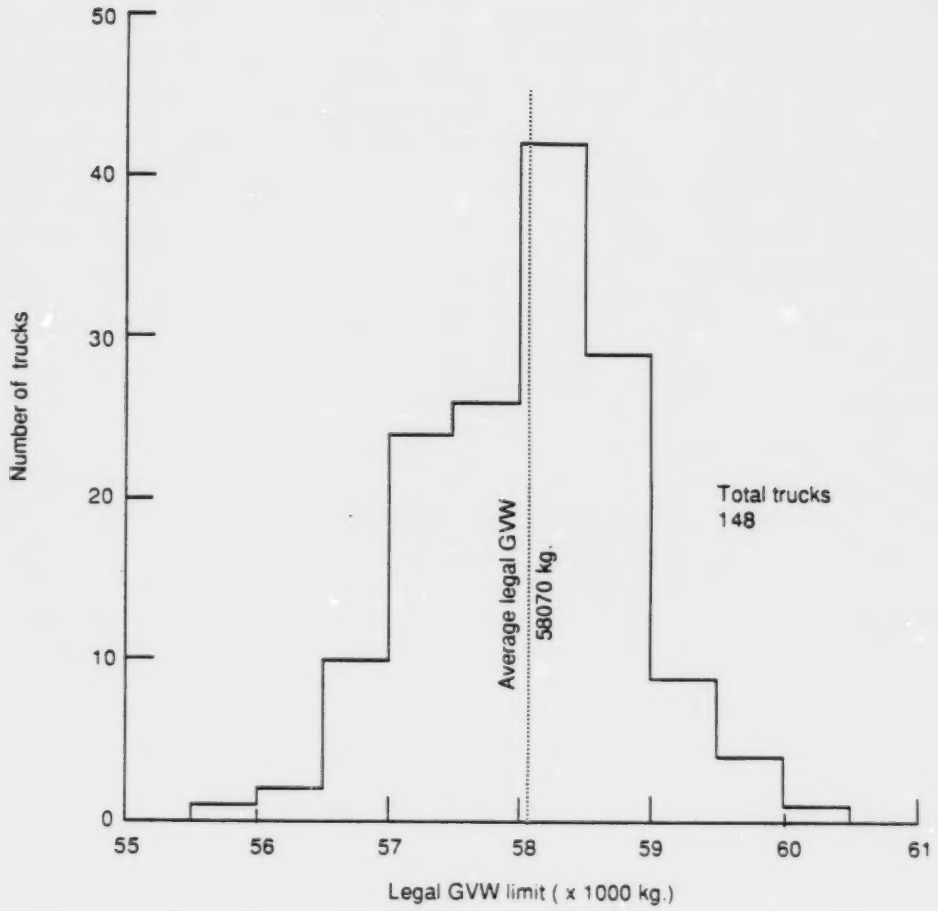


Figure 9/ Distribution of legal GVW limit in 7-axle (3S4) logging trucks

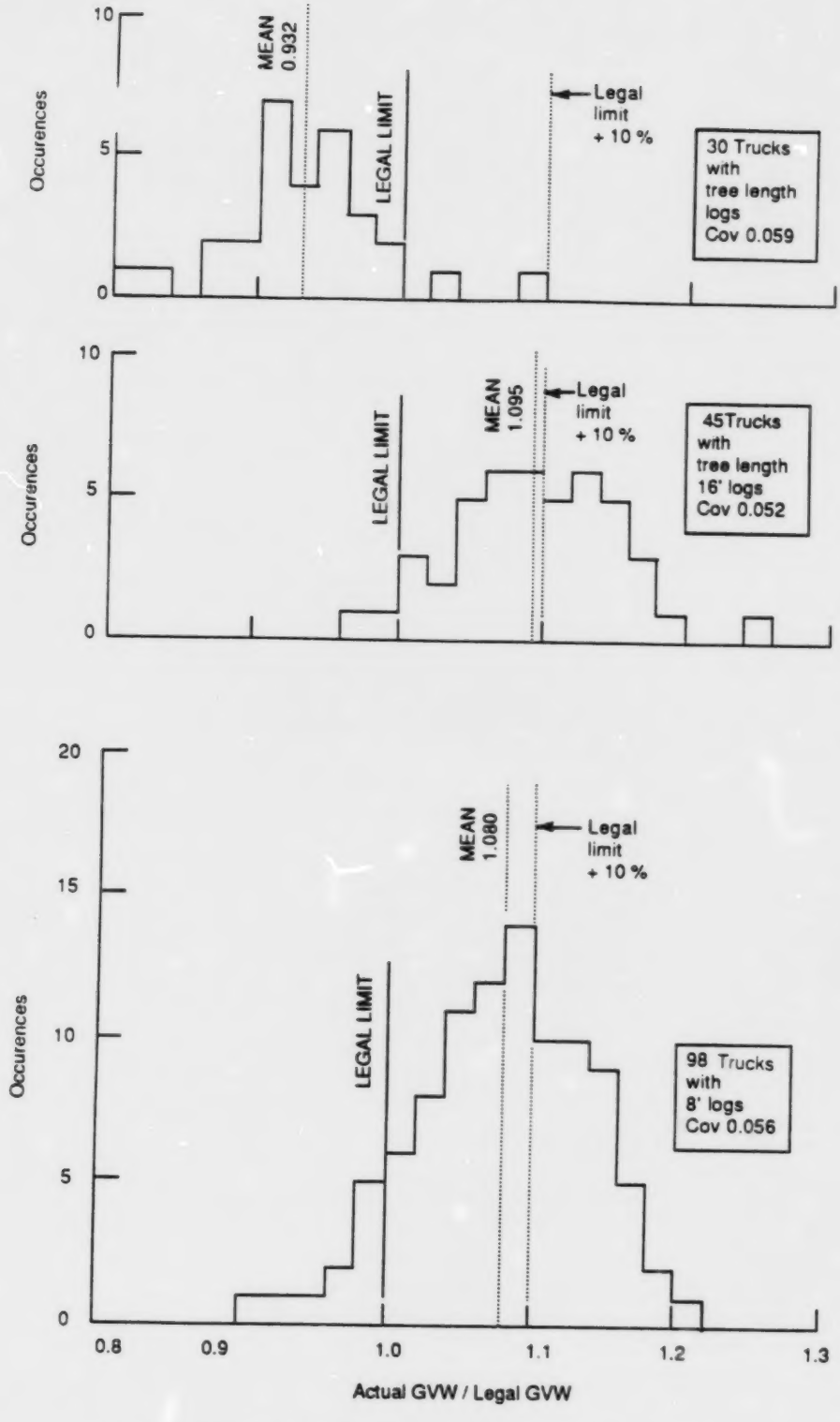


Figure 10/ Distribution of ratio (actual GVW / legal GVW) for trucks from survey

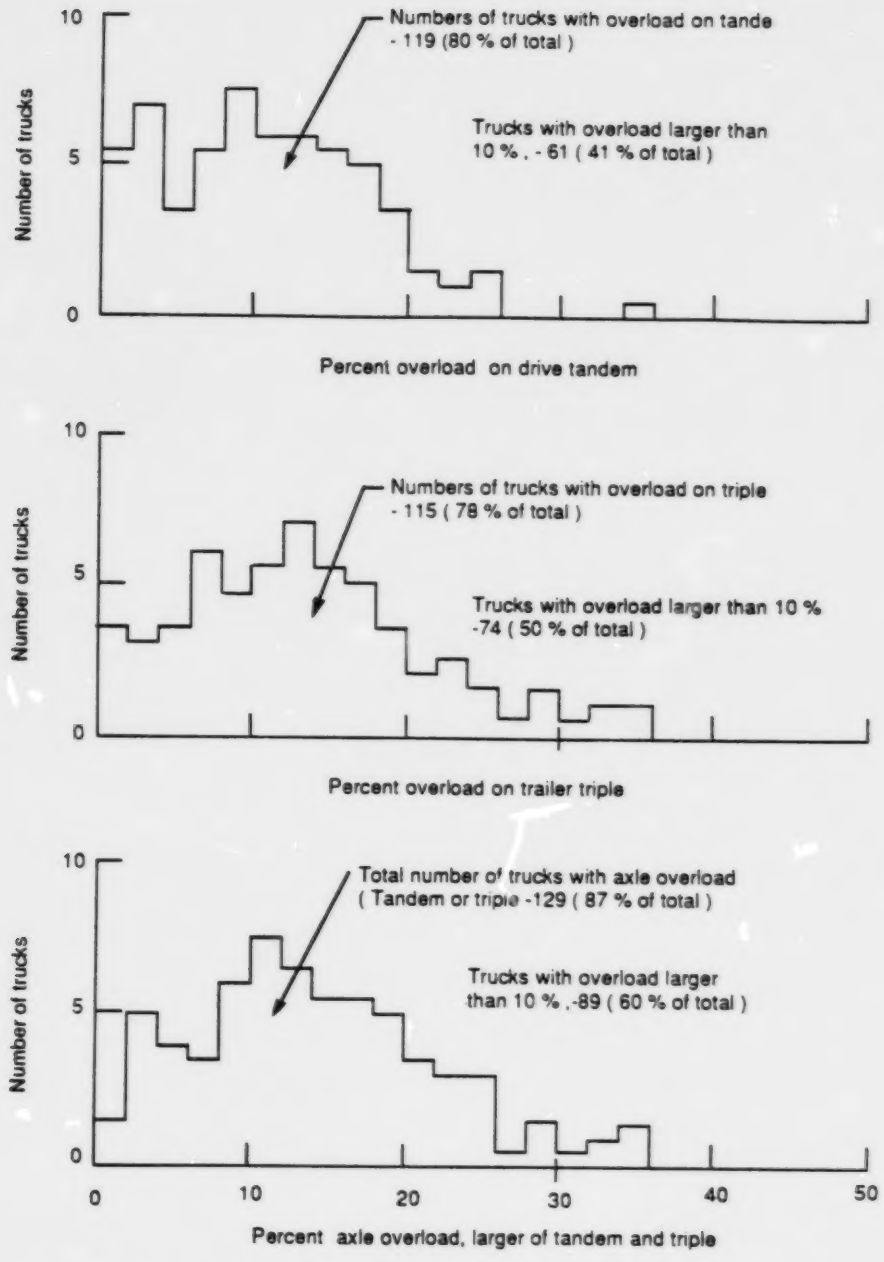

Number of trucks
10
5
0
Numbers of trucks with overload on tande
- 119 (80 % of total)
Trucks with overload larger than
10 % , - 61 (41 % of total)
Percent overload on drive tandem
Number of trucks
10
5
0
Numbers of trucks with overload on triple
- 115 (78 % of total)
Trucks with overload larger than 10 %
-74 (50 % of total)
Percent overload on trailer triple
Number of trucks
10
5
0
Total number of trucks with axle overload
(Tandem or triple -129 (87 % of total)
Trucks with overload larger
than 10 % ,-89 (60 % of total)
0
10
20
30
40
50
Percent axle overload, larger of tandem and triple

Figure 11/ Axle weight overloads in 7-axle trucks, configuration 3S4; total trucks 148

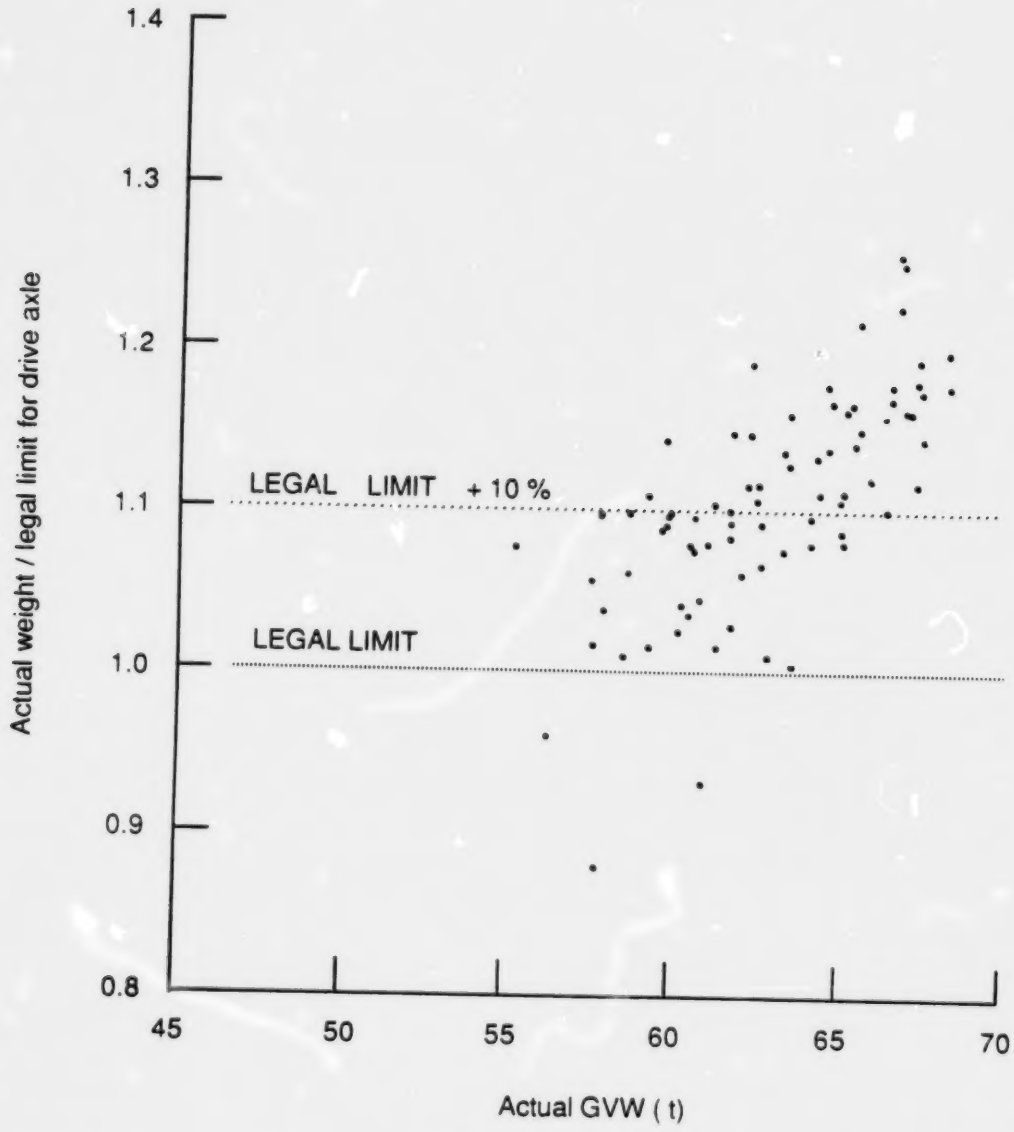


Figure 12 (a)/ Load on drive tandem in 7-axle logging trucks loaded with 8 ft logs

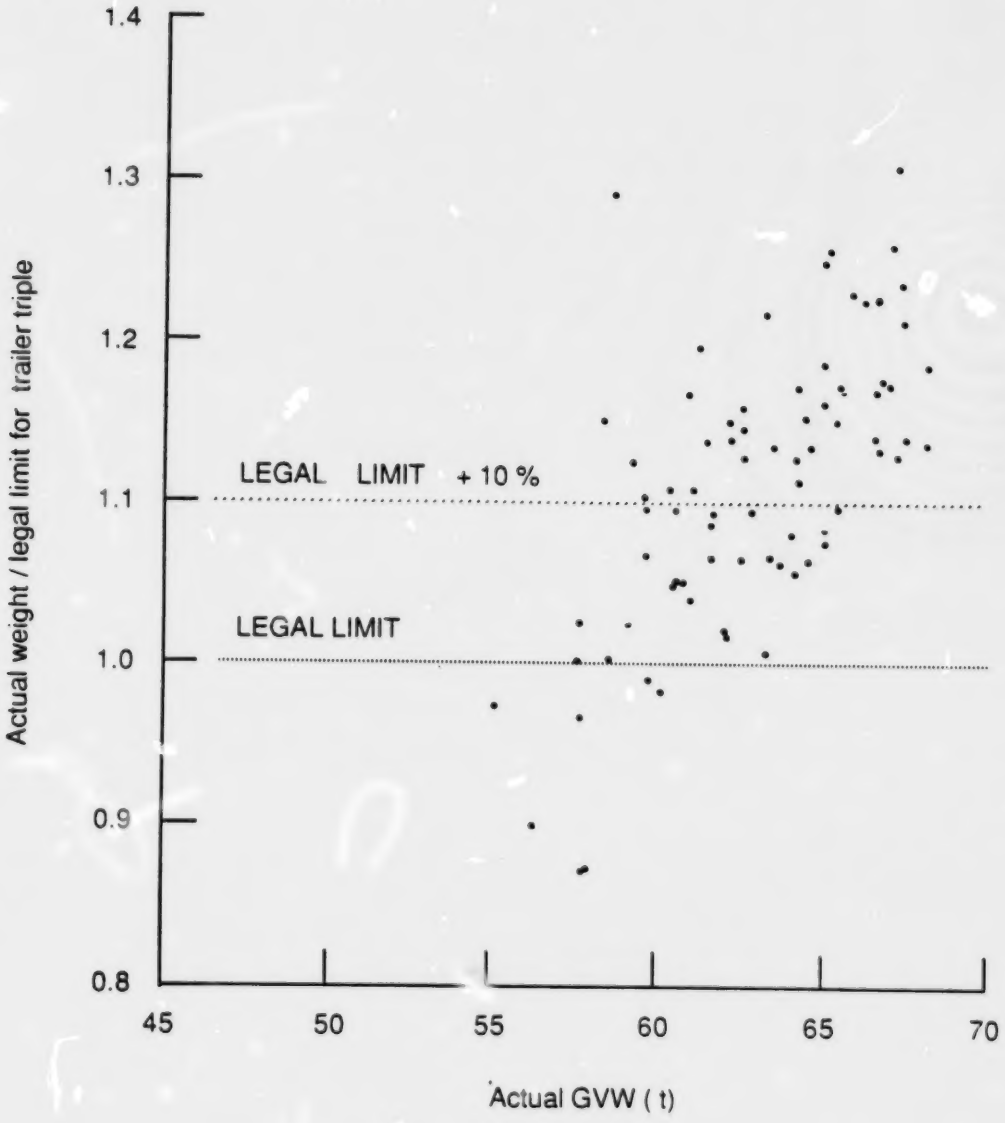


Figure 12 (b)/ Load on triple trailer in 7-axle logging trucks loaded with 8 ft logs

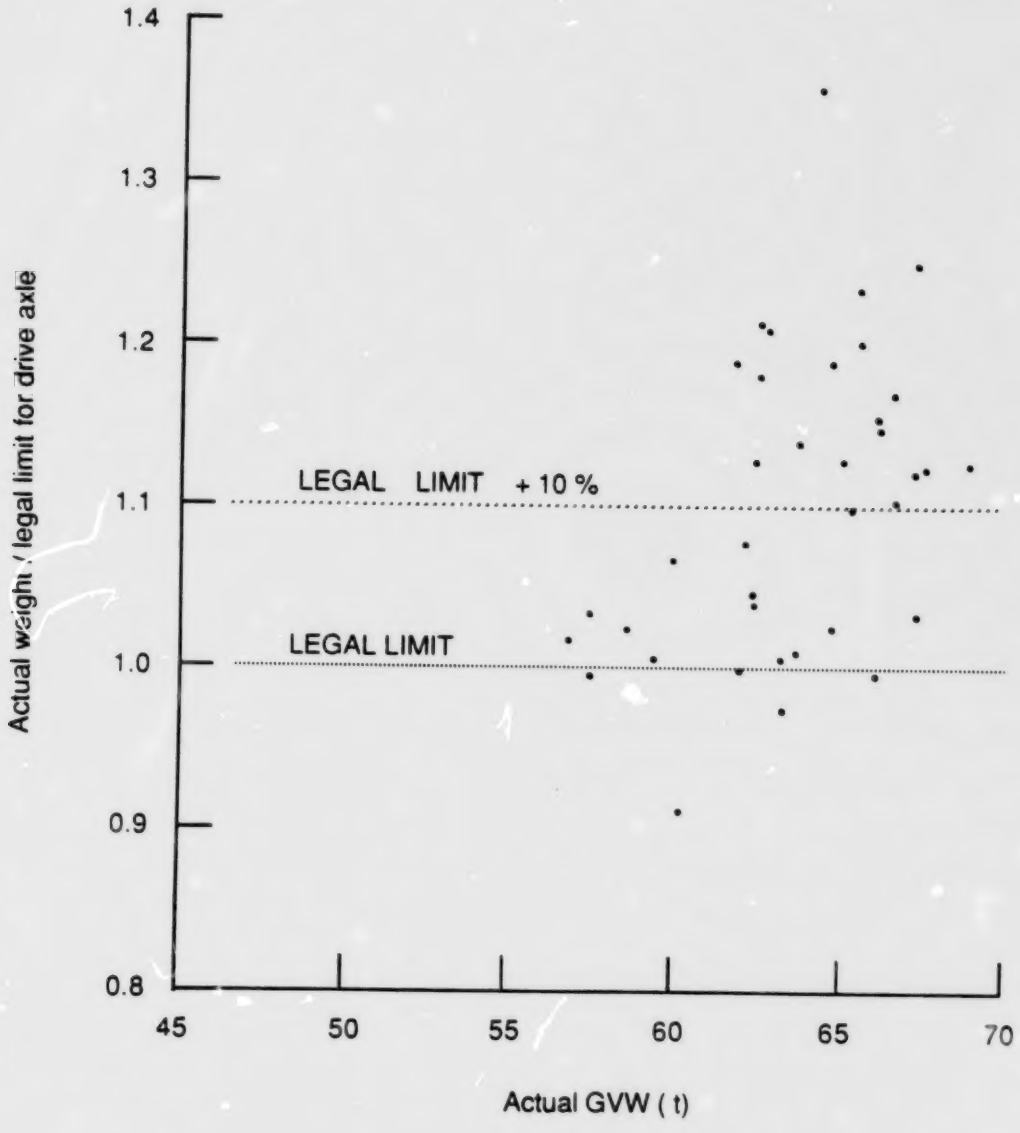


Figure 13 (a)/ Load on drive tandem in 7-axle logging trucks loaded with 16 ft logs

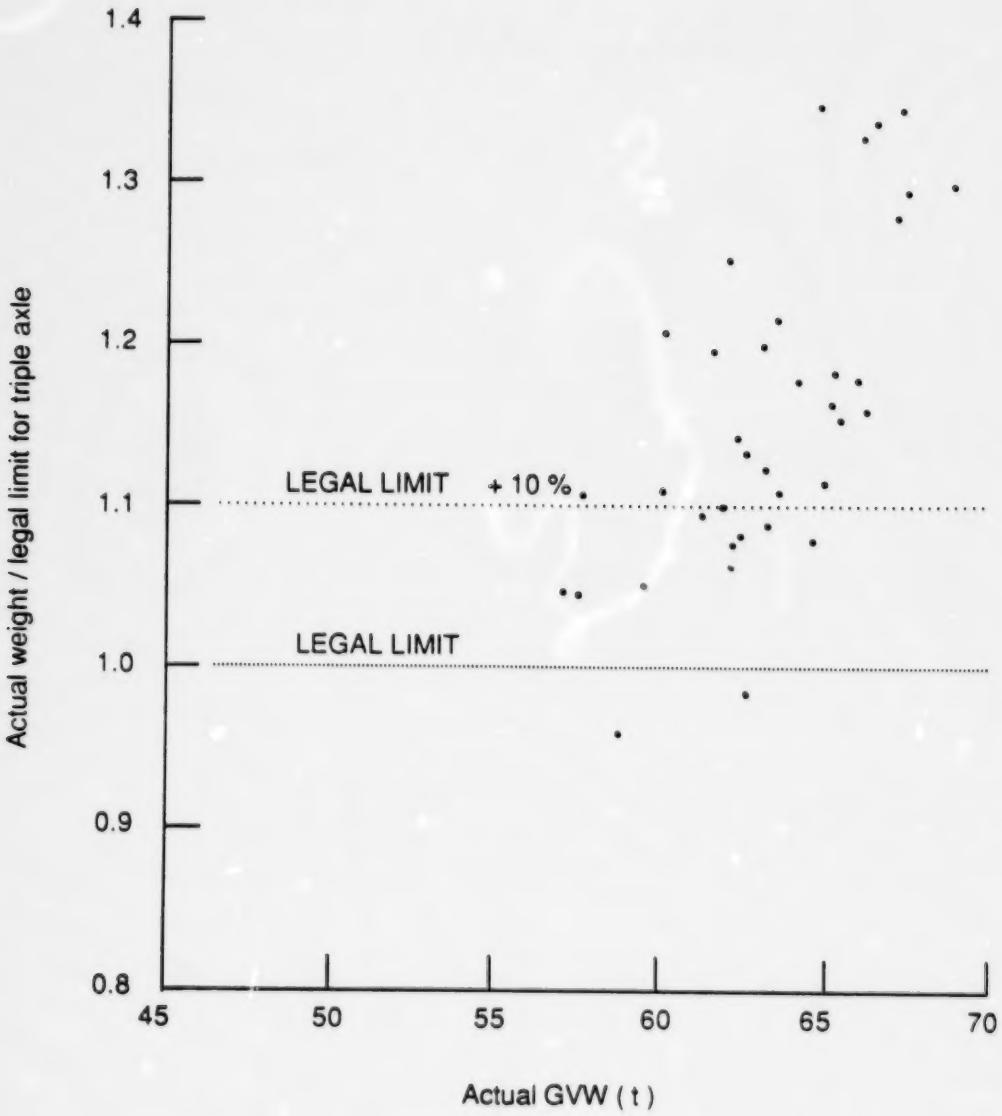


Figure 13 (b)/ Load on trailer triple axle in 7-axle logging trucks loaded with 16 ft logs

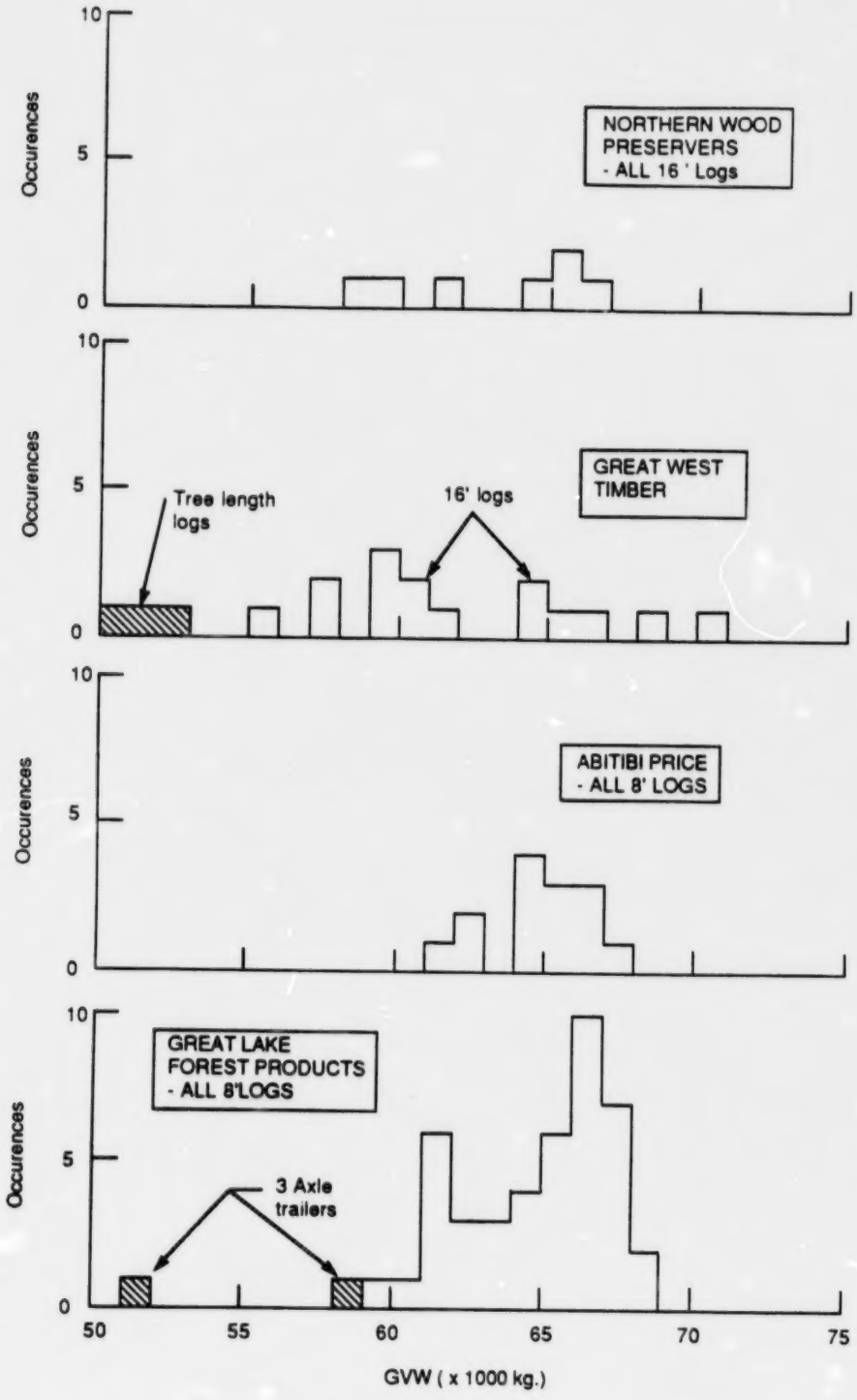
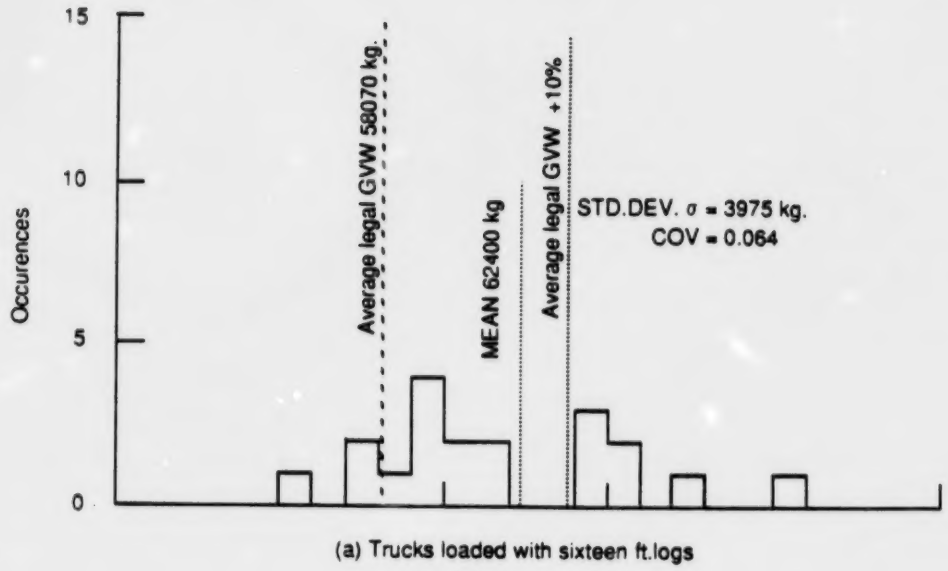
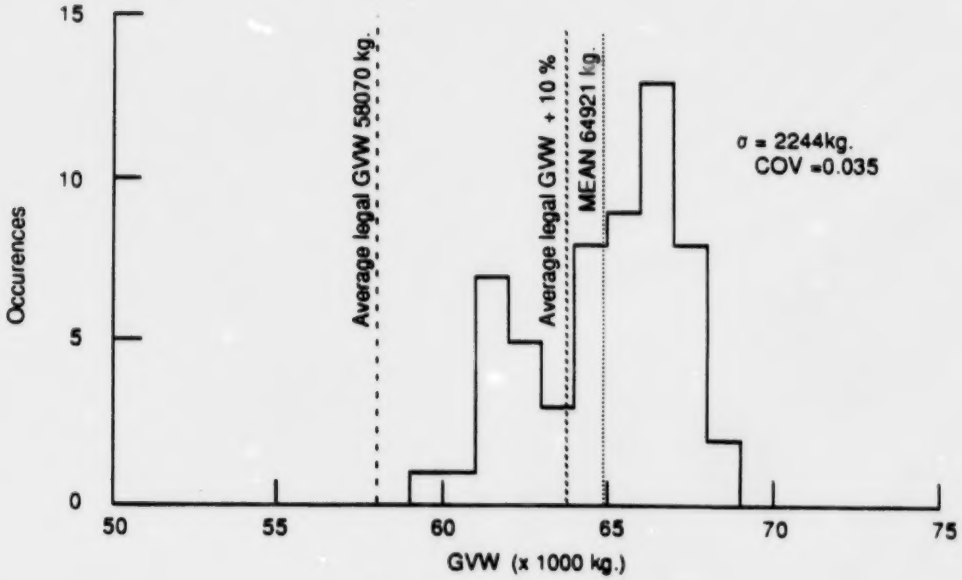


Figure 14/ Distribution of gross vehicle weights obtained from the logging company mill scales



(a) Trucks loaded with sixteen ft.logs



(b) Trucks loaded with eight ft. logs

Figure 15/ Distribution of GVW from logging company mill scales, categorised by load type

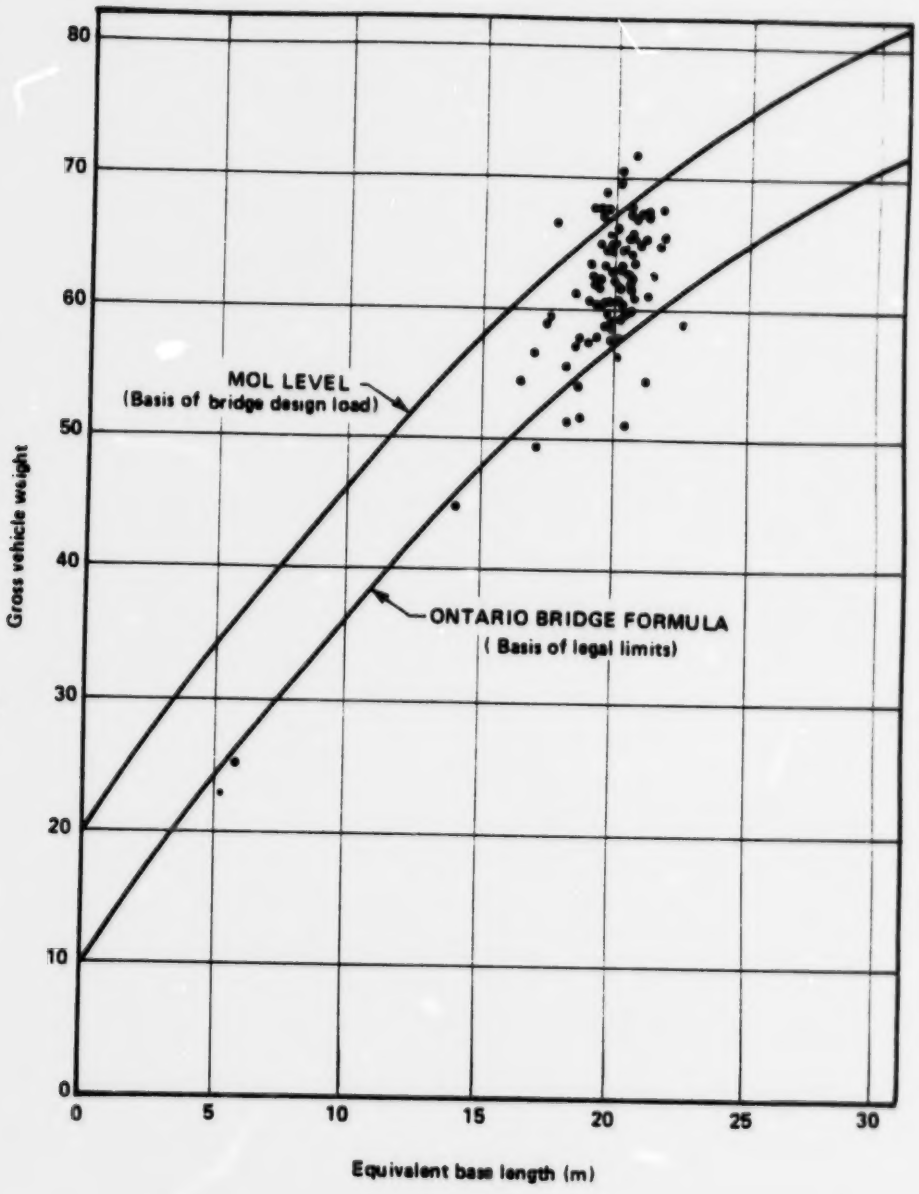


Figure 16 (a)/ Comparison of gross vehicle weights to the Ontario Bridge Formula, for trucks with 8 ft logs

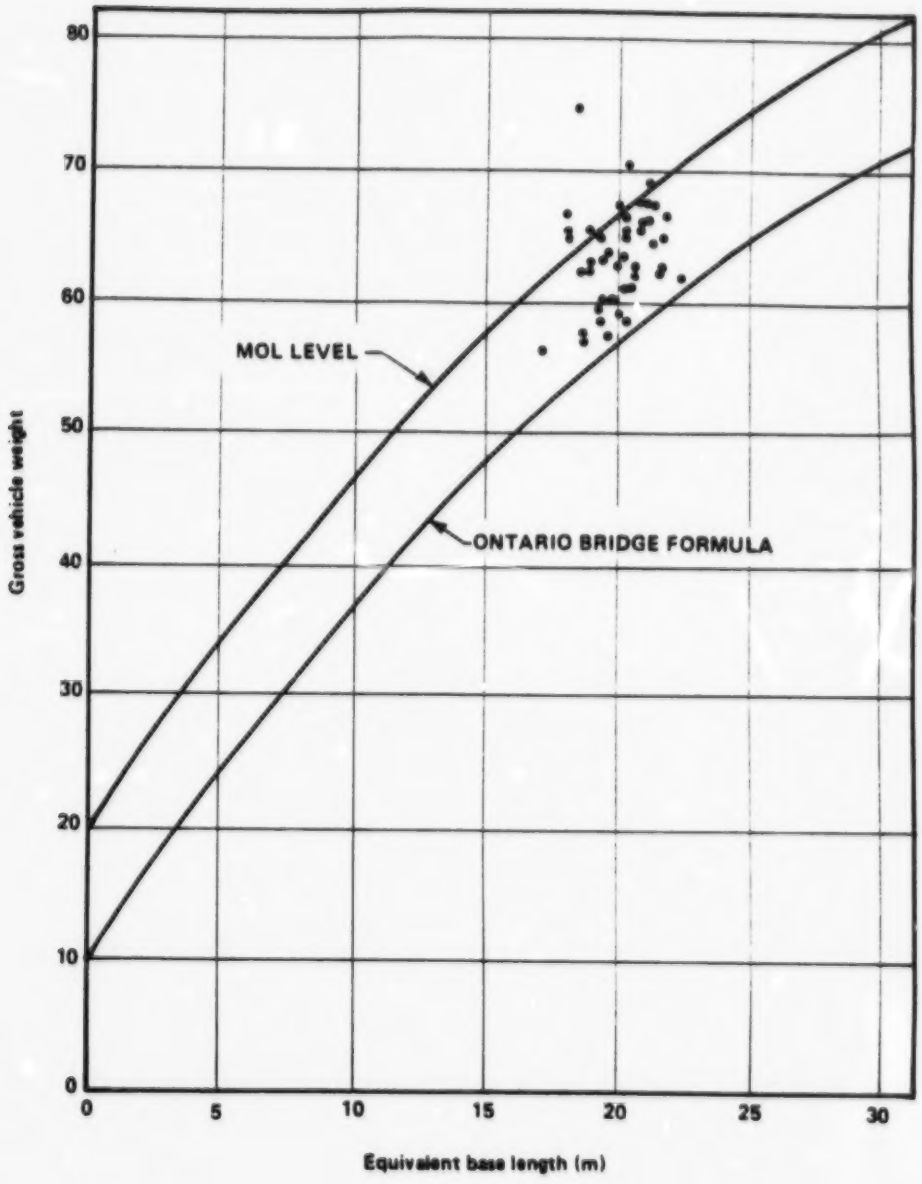


Figure 16 (b)/ Comparison of gross vehicle weights to the Ontario Bridge Formula, for trucks with 16 ft logs

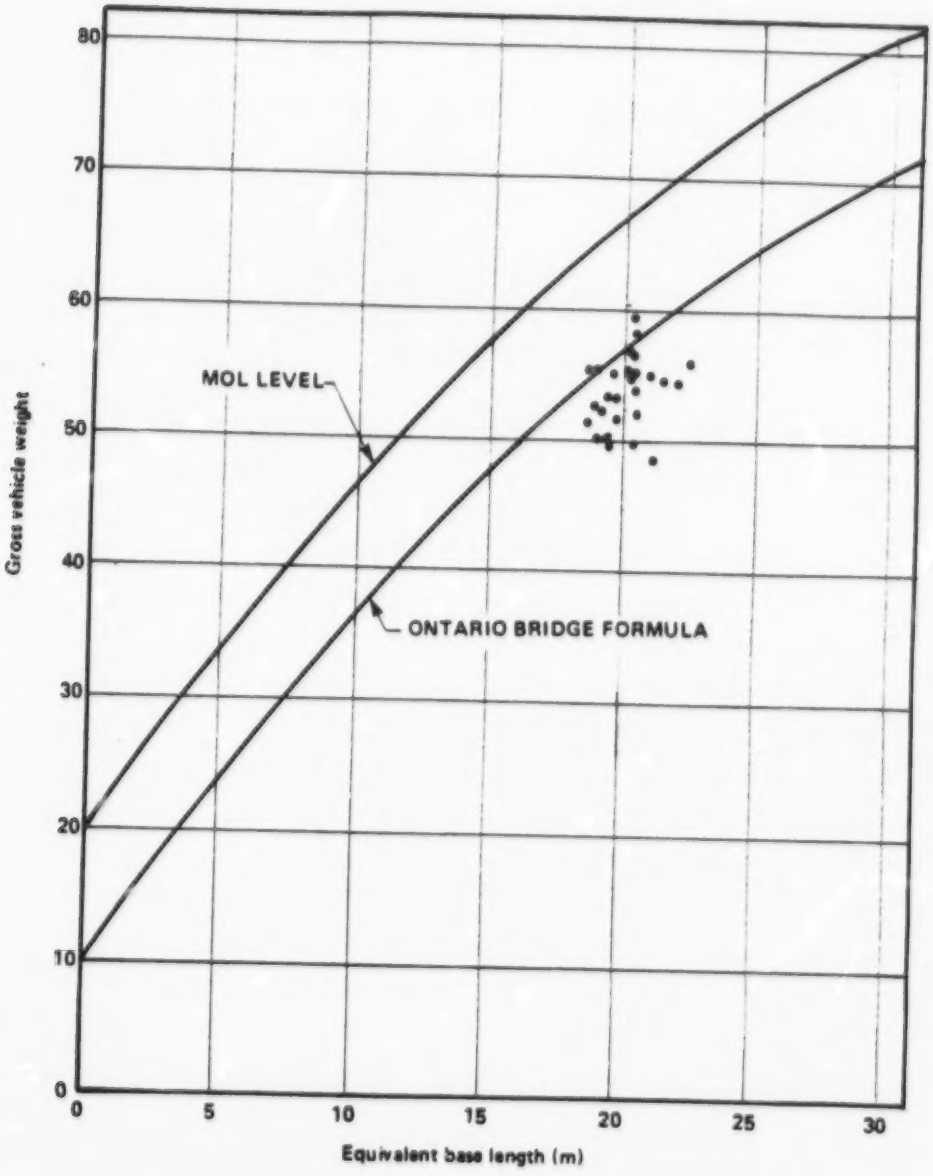


Figure 16 (c)/ Comparison of gross vehicle weights to the Ontario Bridge Formula, for trucks with tree-length logs

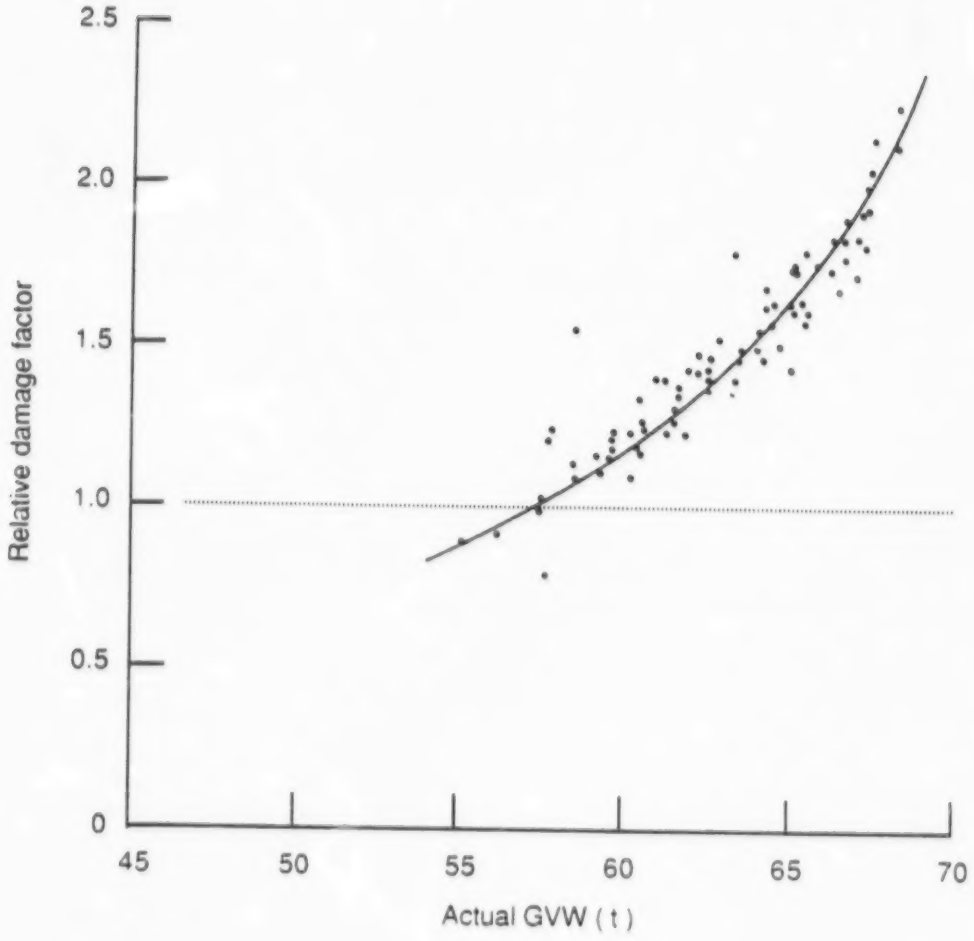


Figure 17 (a)/ Relative damage factor for pavement due to 7-axle trucks from the survey loaded with 8 ft logs

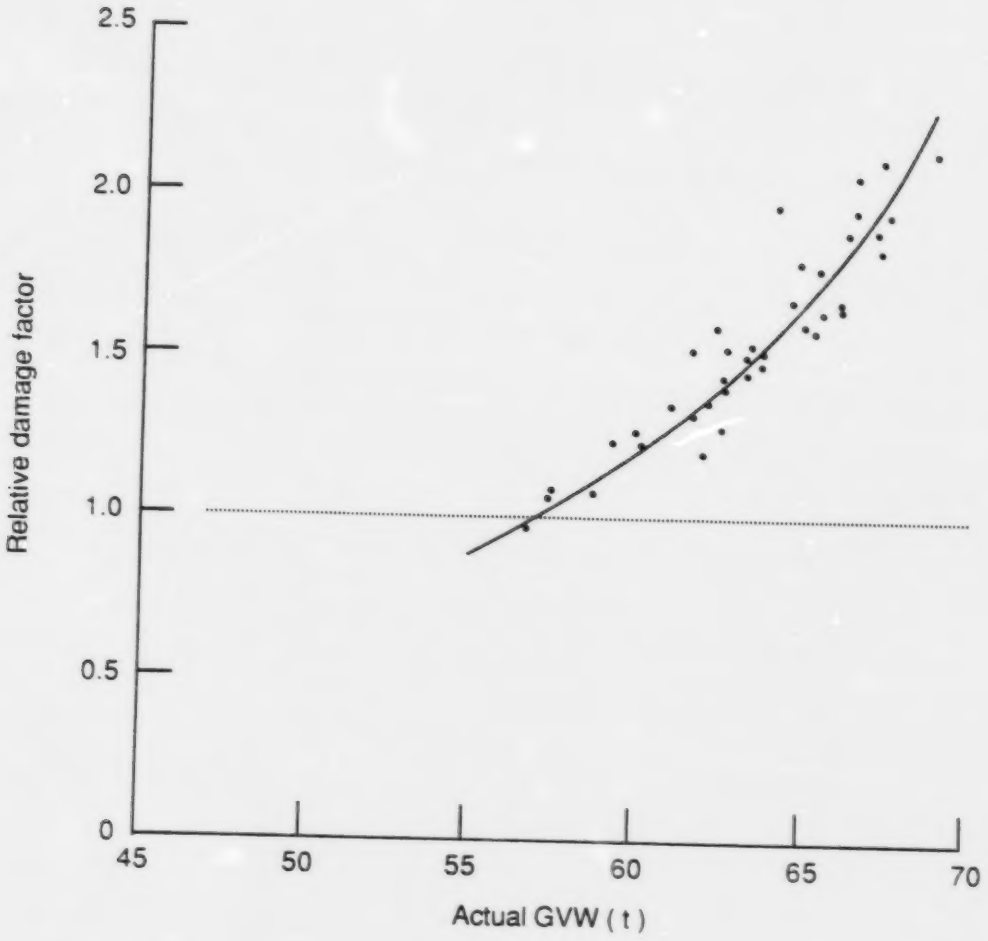


Figure 17 (b)/ Relative damage factor for pavement due to 7-axle trucks from the survey loaded with 16 ft logs

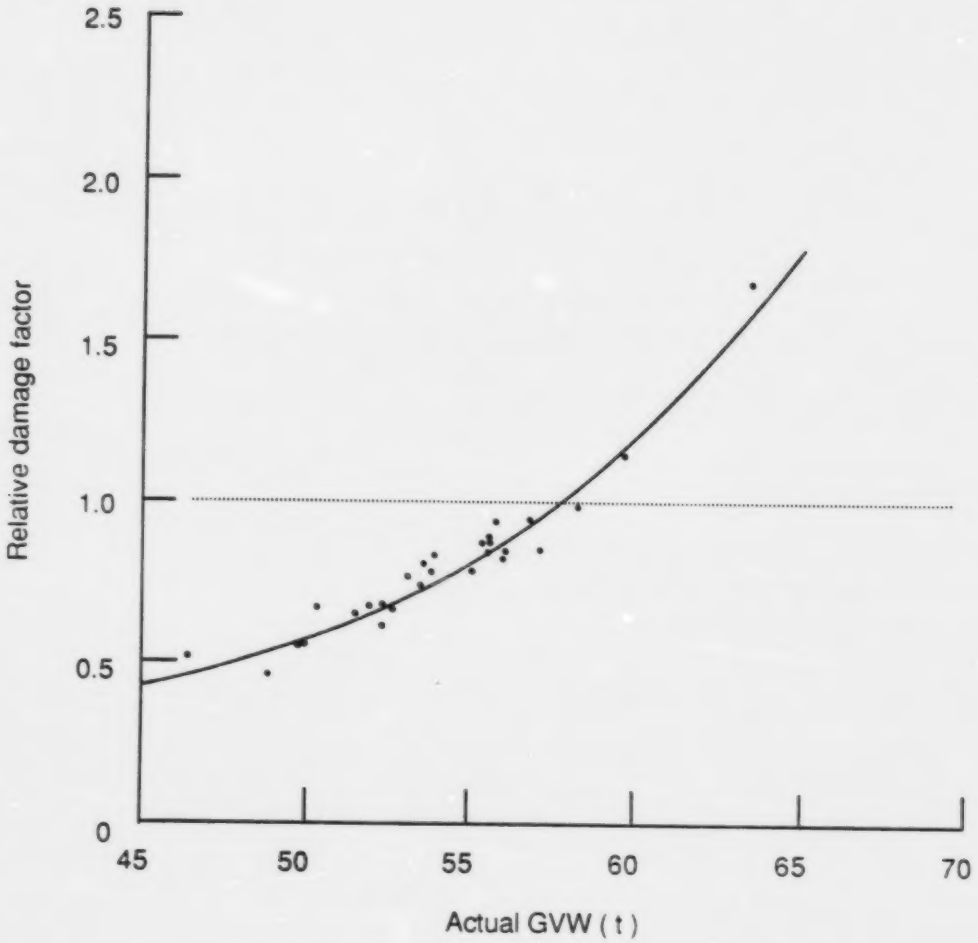


Figure 17 (c)/ Relative damage factor for pavement due to 7-axle trucks from the survey loaded with tree-length logs

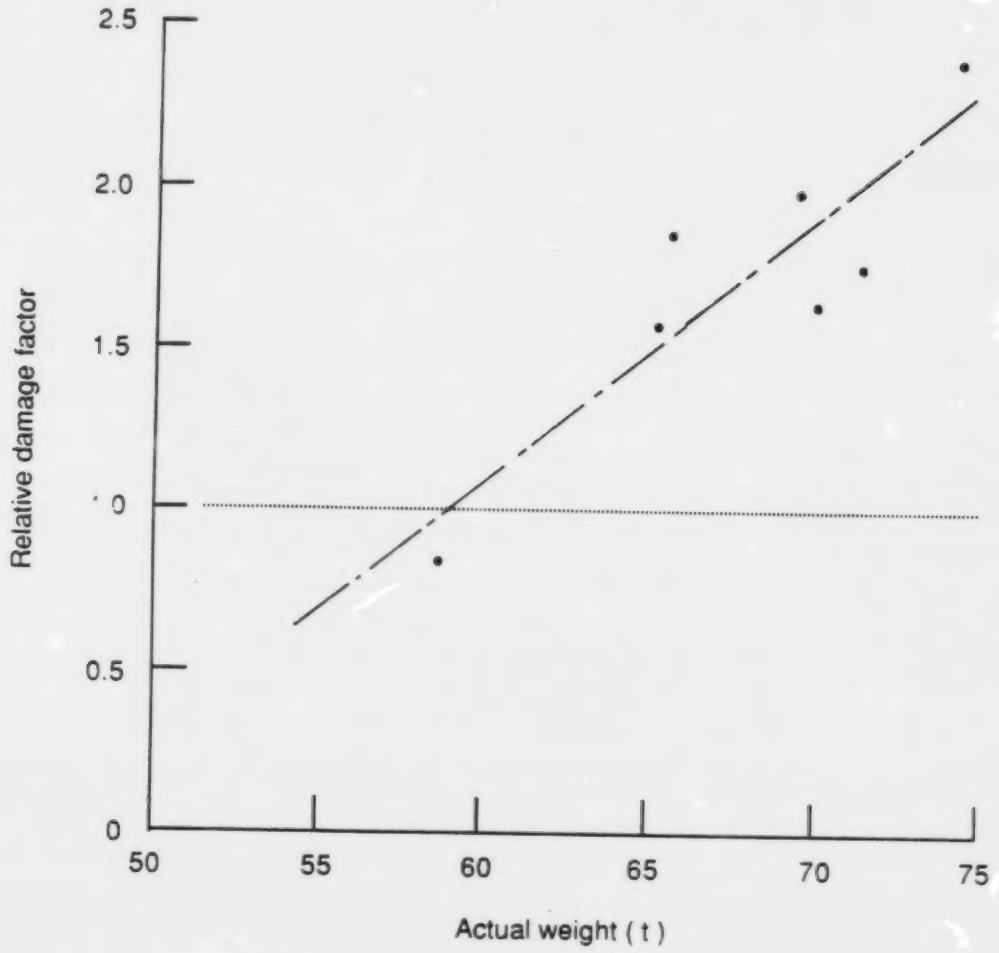


Figure 18/ Relative damage factor for pavement due to 8-axle trucks, configuration 3S5, from the survey

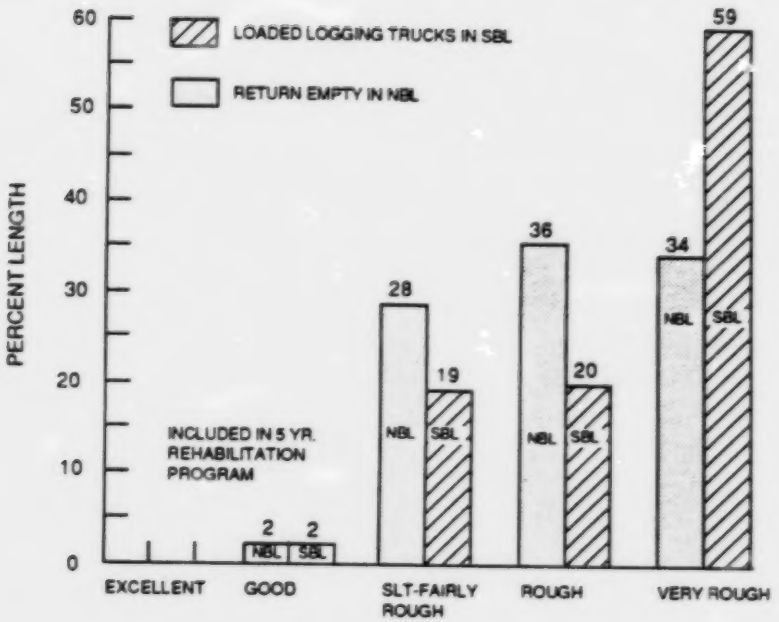


Figure 19/ Quality of ride (Mays Meter)
Hwy 527, Wildgoose to Dorion Rd., 46.7 km

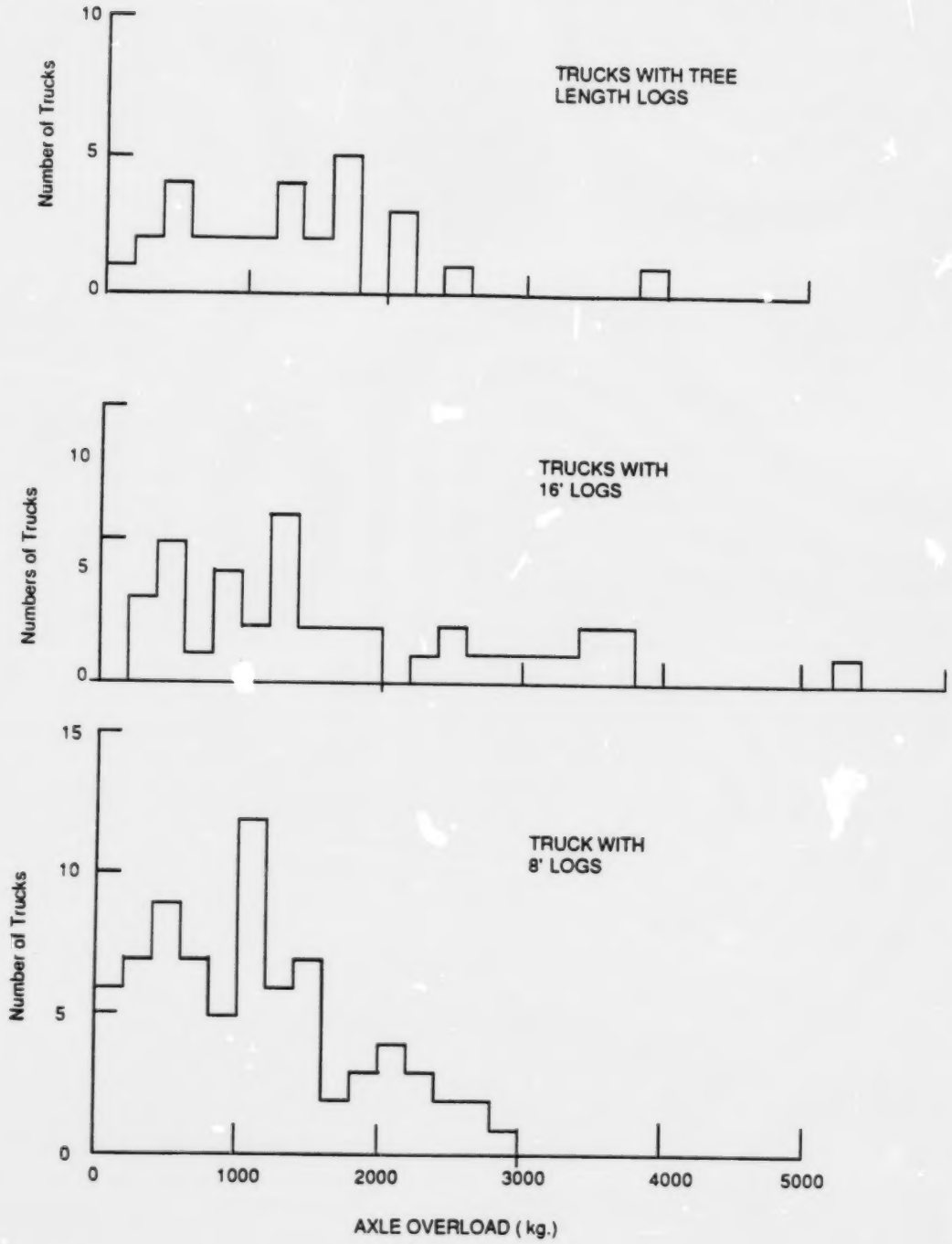


Figure 20/ Potential overload on axles (drive tandem or trailer triple) if trucks loaded to the legal GVW limit

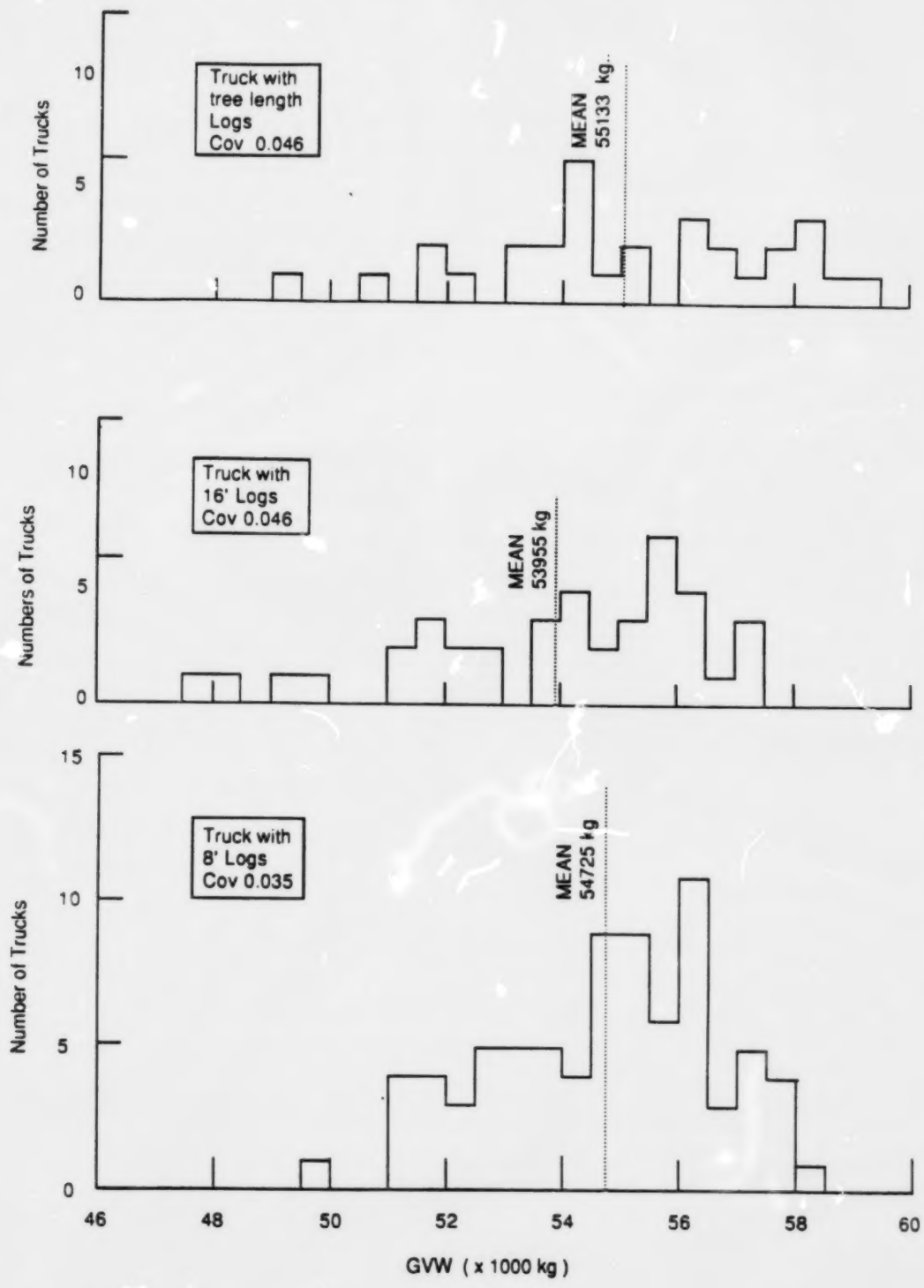
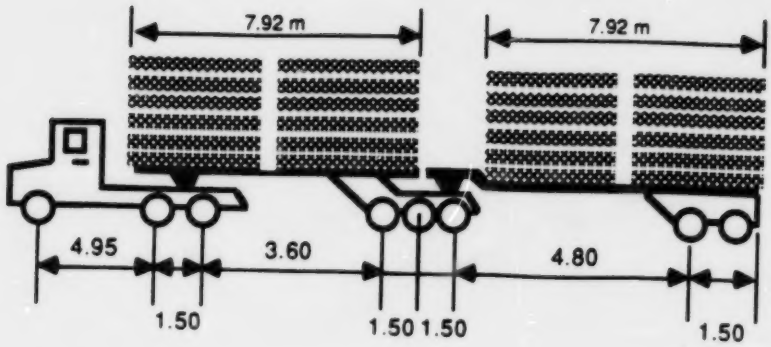


Figure 21/ Distribution of maximum possible gross vehicle weight on 7-axle survey trucks, configuration 3S4, without exceeding axle weight limits



EMPTY WEIGHTS	4500	5900	6500	3400	= 20300 kg
LOADED WEIGHTS	7000	17900	22400	16200	= 63500 kg
PAYLOAD					43200 kg

Figure 22/ A typical B-train combination to carry 8 ft logs placed lengthwise

memorandum

Telephone No. 235-4707

Ontario

To: Mr. T. G. Smith
Assistant Deputy Minister
Safety & Regulations

Date: 87 05 13

Subject: Weight Control in Logging Truck: Final Report

During the fall of 1986, raw forest products industry in the Northwestern Region presented a demand to the Ministry that axle weight control be removed from the logging trucks, and that they be allowed to carry as much load as may be possible within legal length and height limits on such trucks. They argued that due to the variability in the density of different types of wood and the changes in the moisture conditions round the year, the industry has difficulty in accurately loading the trucks within legal limits. Furthermore, they argued that location of the centre of gravity in the tree length logs of different sizes varies along the length of the log, and hence, they have difficulty in proper positioning of the load on the truck to avoid axle overloads.

A preliminary study in December, 1986 showed that removing the axle weight control would seriously undermine the weight enforcement program and would not be technically acceptable to the Ministry. Also the logging trucks if loaded to the legal height would be overloaded by as much as 30 to 40 percent on the gross vehicle weight (GVW) which would seriously compromise the safety of highway bridges, and prematurely damage the pavements.

The industry was informed of the Ministry's concerns and unacceptability of their demands in a meeting during January, 1987. They agreed to abide with the GVW limits per the Highway Traffic act and Regulations but persisted in their demand for removal of the axle weight control.

This raised two questions,

1. If the logging trucks are loaded to the GVW limit per HTA, would there be serious axle overloads?

2. What should be the GVW limit to ensure that the axles will not be overloaded?

In order to answer these questions a study was undertaken. A survey was conducted to collect data on the existing truck configurations around Thunder Bay during February, 1987 and current situation was evaluated. The enclosed report contains the results of this survey and the recommendations from the study.

It is concluded that the logging trucks will have large axle overloads even if loaded to within GVW limits. In order to ensure compliance with the axle weight limits, permissible GVW will have to be significantly reduced from the current limits. It is recommended that the axle weight control be retained and multi-platform scales be installed to permit accurate weighing of the logging trucks.

Due to the sensitive nature of the contained information, the report has been restricted for internal circulation only. However, the information may be used by your office as deemed appropriate in your discussions with the industry, or otherwise.

P. Smith,
Director,
Research & Development Branch.

Enclosure/-

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